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research division

EXECUTIVE SUMMARY

BOOTH QUARRY GROUND WATER MONITORING JULY, 1986

J. Complak
Process Chemistry Section
Chemical Research Department

Regular monitoring of ground water at the Booth Quarry fly ash disposal site, Etobicoke, initiated in 1976 at the request of the Ontario Ministry of the Environment, was continued in 1986. A major decrease (first observed in November, 1982) in the concentration of dissolved components of ground water in the central sump, persists into 1986. Characteristics of waters in other observation wells at the site remain essentially unchanged. Piezometric head measurements show that the water table remains fairly steady. Monitoring continues.

job	file	date	report no.
31-161-892	837.71	January 23, 1987	86-349-K

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new 82-10

ontario hydro
research division

To: Mr. D. Erwin
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Attn: Mr. J.H.P. Buckingham
Senior Supervisor
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BOOTH QUARRY GROUND WATER MONITORING
JULY, 1986

J. Complak

A major decrease (first observed in November, 1982) in concentration of dissolved components in the ground water from the central sump, persists into 1986. Characteristics of waters in other observation wells at the site remain essentially unchanged. Piezometric head measurements show that the water table remains fairly steady. Monitoring continues.

Ground water samples were taken from the central sump and four peripheral monitoring wells at Booth Quarry ash disposal site, Etobicoke, on July 29, 1986. Sampling locations are shown in Figure 1. Observation wells OW-2-77 and OW-08-77, inaccessible and not sampled in 1985, were sampled in 1986. Analytical results for 1986 are given in Table I, and summaries of major ion balances from 1977 through 1986 are given in Tables II - VI. Piper diagrams (Figures 2 - 6) for individual observation wells contain historic data for each location/1/. These again show that ground waters taken from the central sump, OW-1-82 and OW-6-82 continue to have no dominance of major ions. Ground waters from wells OW-2-77 and OW-8-77 remain, as of June, 1984, in the region of dominance of alkaline earths and weak acid anions.

Chemical characteristics of the central sump water again reflect continuation of a major dilution (approximately 20:1) which occurred following the sampling of June, 1982, when concentrations of most components decreased to levels below those reported/2/ for Lake Ontario water. It was then suggested/3/ that the observed dilution might have resulted from infiltration of precipitation and run-off through the still uncovered fly ash fill surrounding the central sump.

The concentration of zinc in the central sump water increased in 1986 to 0.83 mg/L from the <0.02 mg/L level in September, 1985/1/. This reflects continuing fluctuations of zinc levels above and below the detection limit observed intermittently throughout the monitoring program which began in 1976.

86-349

Such changes are attributed to corrosion of the galvanized well casing. During 1986 there was a drop in cadmium level in the sump water from the 1985 level of 0.0007 mg/L to below the detection limit of 0.0002 mg/L. Similar fluctuations in cadmium concentration, particularly in the sump water, have occurred in the past/1,3,4,5/. All of these observed excursions are still below maximum acceptable concentrations published in the Ontario Drinking Water Objectives, ie, 0.005 mg/L for cadmium and 5.0 mg/L for zinc/6/.

The 1986 piezometric head survey (Table VII) shows little overall change in the water table since the 1985 measurement except that the level in the central sump increased by approximately 0.5 m above the 1985 level. Levels in the other observation wells remain fairly steady. Monitoring continues.

Approved by:

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kw

REFERENCES

1. Ontario Hydro Research Division Report 85-346-K, 1985.

2. Ontario MOE, 1978. Unpublished data.

3. Ontario Hydro Research Division Report 83-15-K, 1983.

4. Ontario Hydro Research Division Report 84-389-K, 1984.

5. Ontario Hydro Research Division Report 80-523-K, 1980.

6. "Ontario Drinking Water Objectives." Published by the Ontario Ministry of the Environment, 1983.

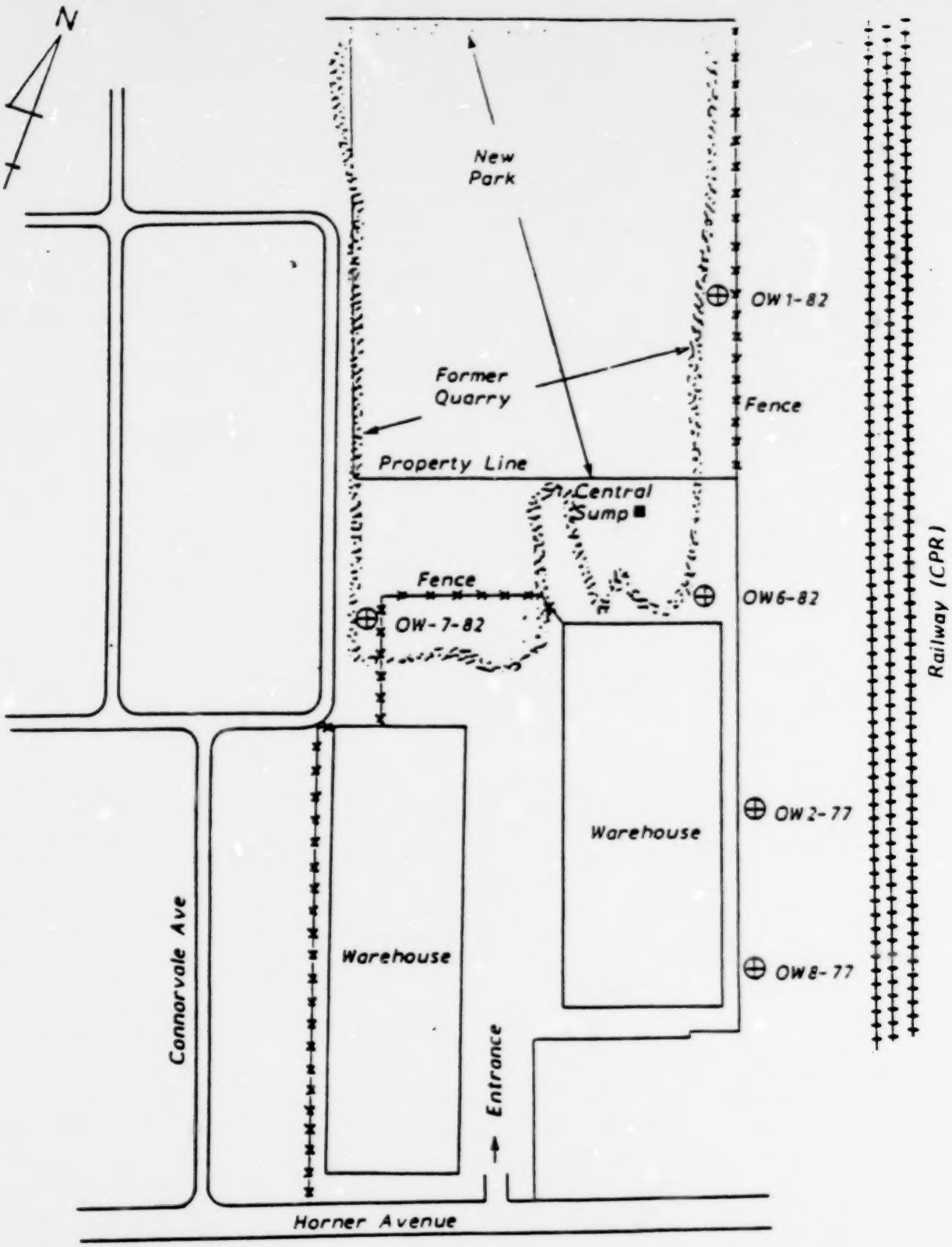


FIGURE 1

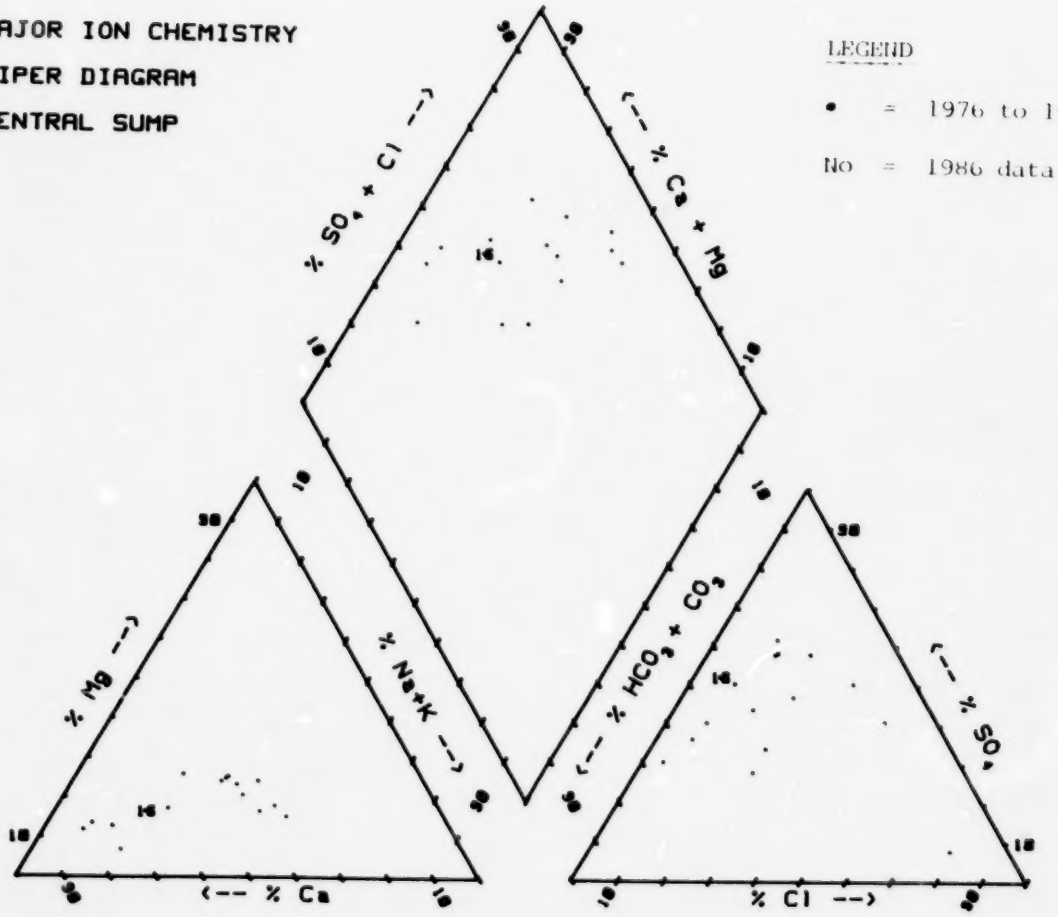
BOOTH QUARRY ASH DISPOSAL SITE
(Not to Scale)

158887-RD

MAJOR ION CHEMISTRY

PIPER DIAGRAM

CENTRAL SUMP



LEGEND

• = 1976 to 1985 data

No = 1986 data (July) for sample No in Table II

Figure 2

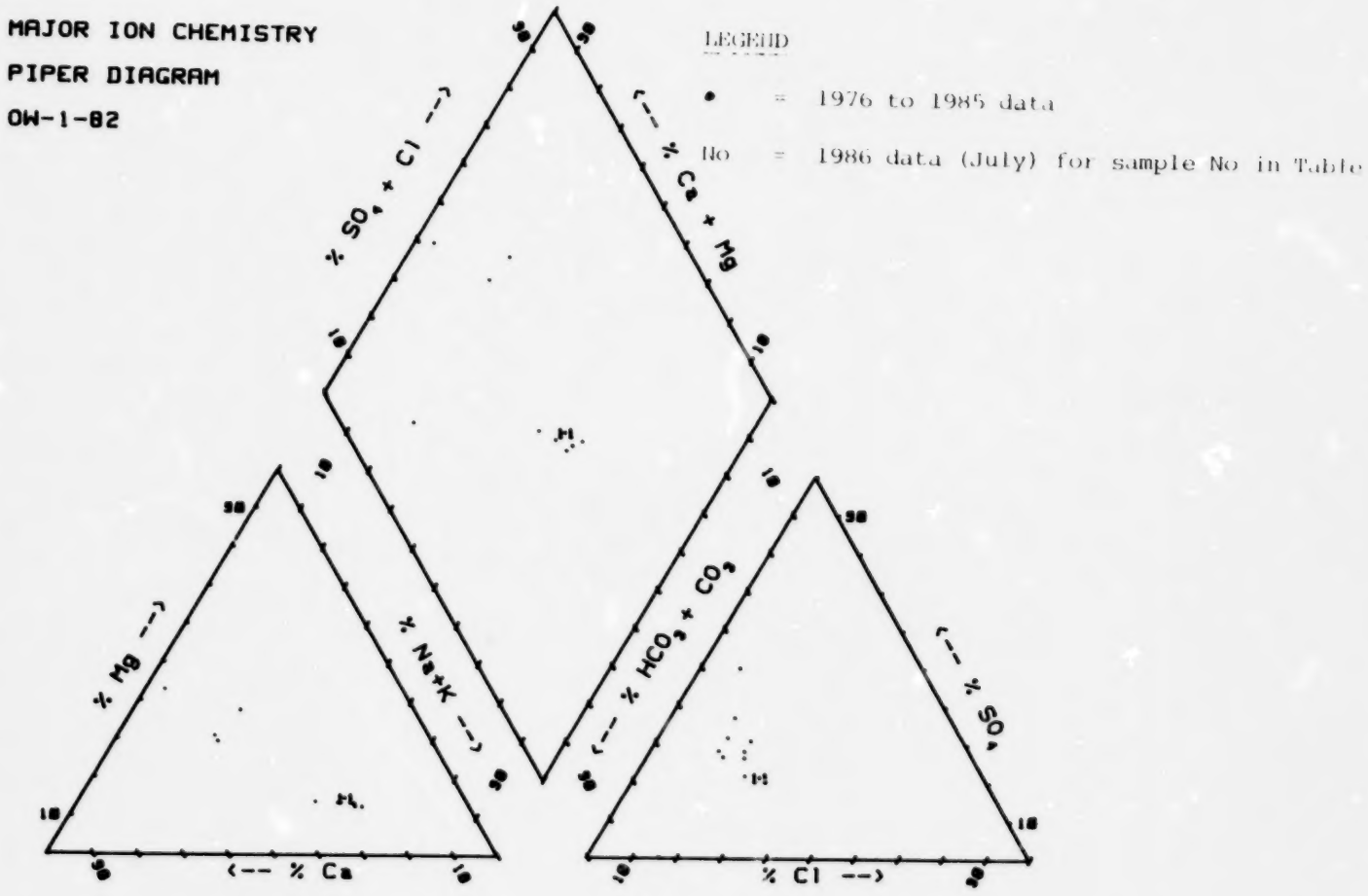
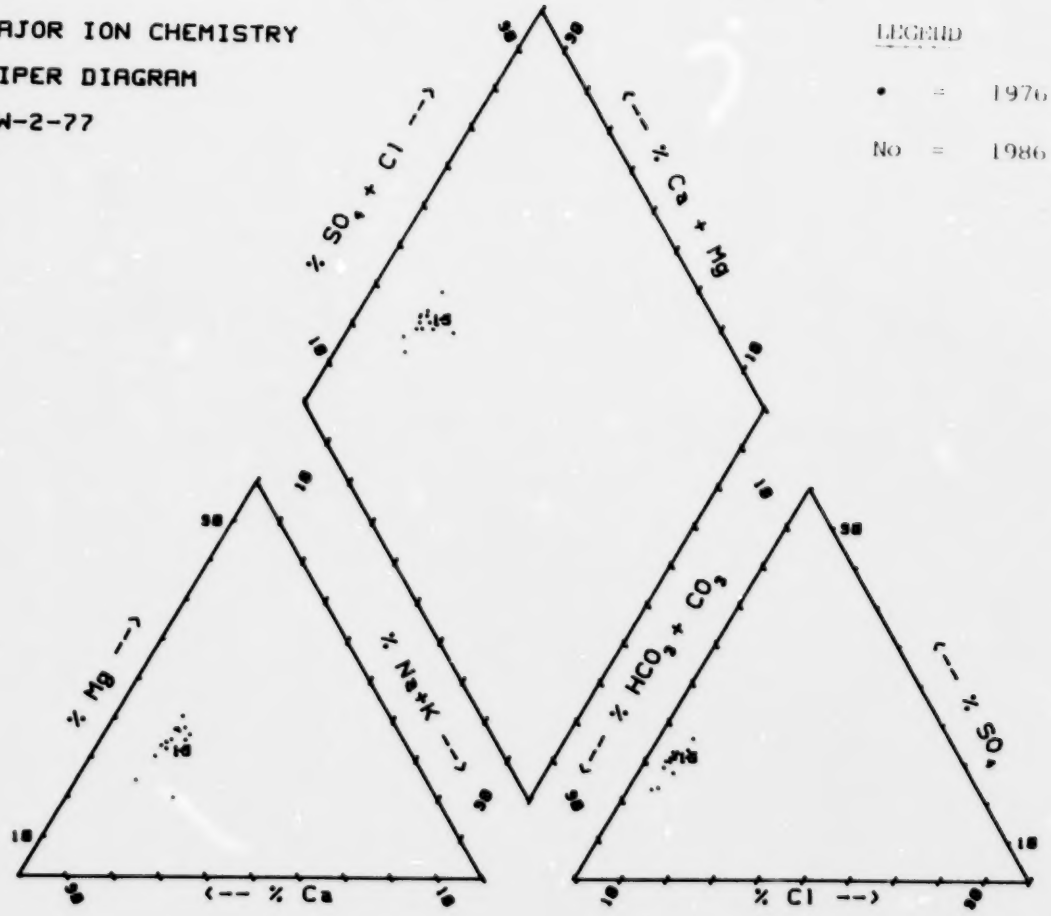

MAJOR ION CHEMISTRY
PIPER DIAGRAM
OW-1-82
LEGEND
• = 1976 to 1985 data
No = 1986 data (July) for sample No in Table
% SO4 + Cl -->
<-- % Ca + Mg
% Mg -->
% Na+K -->
<-- % HCO3 + CO3
<-- % SO4
<-- % Ca
% Cl -->

Figure 3

MAJOR ION CHEMISTRY

PIPER DIAGRAM

OW-2-77



LEGEND

• = 1976 to 1985 data

No = 1986 data (July)

Figure 4

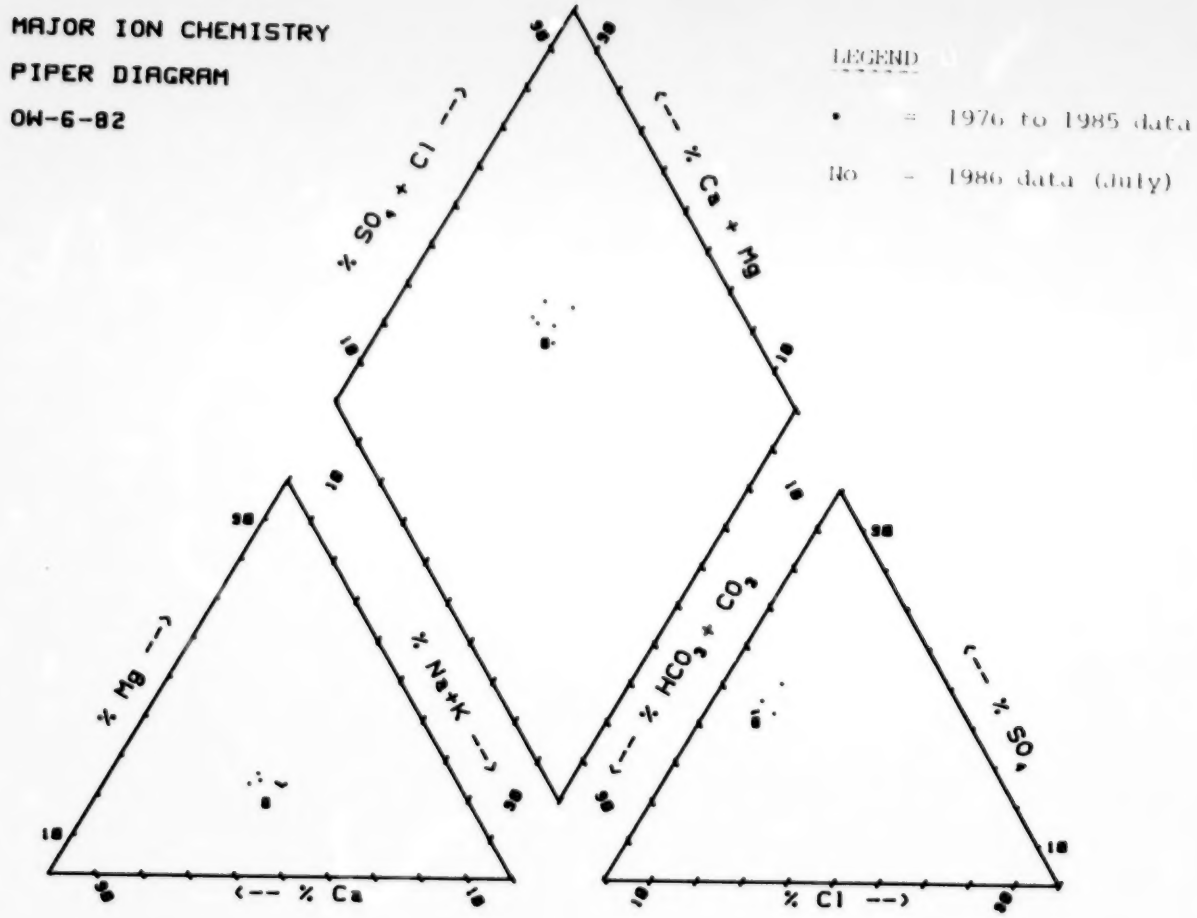

MAJOR ION CHEMISTRY
PIPER DIAGRAM
OW-6-82
LEGEND
• = 1976 to 1985 data
No = 1986 data (July)
% SO4 + Cl -->
<-- % Ca + Mg
% Mg -->
% Na+K -->
<-- % HCO3 + CO3
<-- % SO4
<-- % Ca
% Cl -->

Figure 5

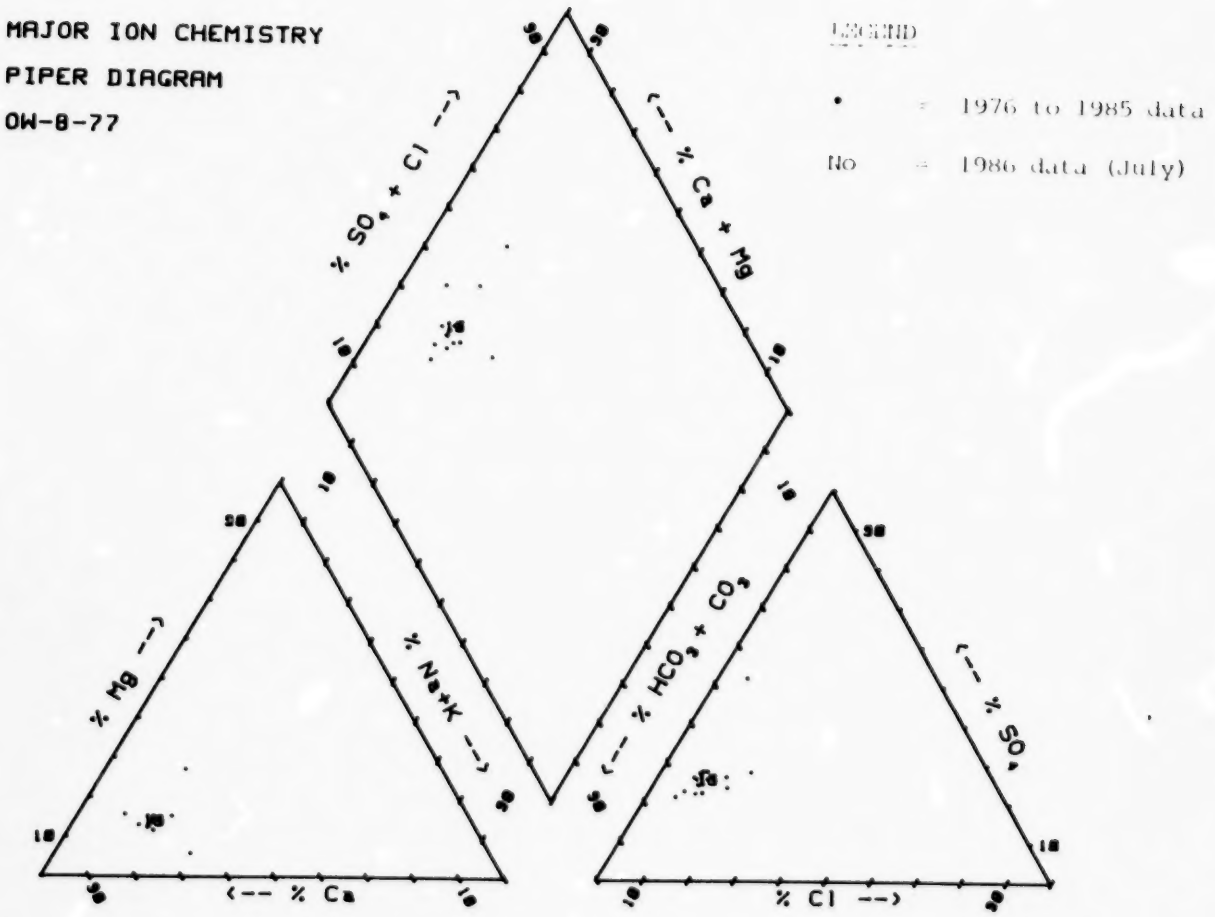

MAJOR ION CHEMISTRY
PIPER DIAGRAM
OW-8-77
LEGEND
• = 1976 to 1985 data
No = 1986 data (July)
% SO4 + Cl -->
<-- % Ca + Mg
% Mg -->
% Na+K -->
<-- % HCO3 + CO3
<-- % SO4
<-- % Ca
% Cl -->

Figure 6

Table I

Chemical Characteristics of Booth Quarry Ground Water

Location ⟶	Central Sump	OW-1-82	OW-2-77	OW-6-82	OW-8-72
PH	6.90	7.90	7.70	7.60	7.80
COND	26.0	116	88.0	127	78.0
ALKOH	<5.00	<5.00	<5.00	<5.00	<5.00
ALKCO3	<5.00	<5.00	<5.00	<5.00	<5.00
ALKHCO3	49.0	317	297	334	257
HARD	96.0	253	409	473	344
SO4	58.0	126	148	277	101
CL	5.00	125	31.5	63.0	33.0
NA	5.00	150	39.0	116	32.0
K	10.0	17.0	8.00	24.0	1.54
CA	31.0	63.0	100	134	114
MG	4.90	21.0	39.0	34.0	14.0
AL	<0.500	<0.500	<0.500	<0.500	<0.500
AS	0.0030	<0.0010	<0.0010	<0.0010	<0.0010
BA	<0.500	<0.500	<0.500	<0.500	<0.500
B	0.600	1.50	0.500	2.00	0.200
CD	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
CR	<0.100	<0.100	<0.100	<0.100	<0.100
CU	0.0100	0.0080	0.0080	0.0100	0.0080
FE	0.180	<0.0500	<0.0500	0.0600	0.0600
PB	0.0100	0.0050	<0.0050	<0.0050	<0.0050
MN	0.0500	0.530	0.0500	0.0700	0.0700
HG	0.0004	<0.0002	<0.0002	<0.0002	<0.0002
MO	<0.500	<0.500	<0.500	<0.500	<0.500
NI	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
SE	<0.0010	<0.0010	0.0040	<0.0010	<0.0010
SR	0.270	1.96	1.09	4.29	0.460
TI	<1.00	<1.00	<1.00	<1.00	<1.00
V	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
ZN	0.830	<0.0200	<0.0200	0.0200	<0.0200
TDS105	200	640	500	770	380

Notes: All concentrations in mg/L.
Alkalinities and Hardness are expressed as calcium carbonate.
pH is in pH units.
Conductivity is expressed in mS/m.

Table II

Major Ion Chemistry
Booth Quarry Ground Water
Location Central Sump

Cations

Date	Number	Calcium			Magnesium			Sodium			Potassium			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Cation	Anion	
770610	1	370.00	18.46	34.13	100.00	8.23	15.21	630.00	27.40	50.66	0.00	0.00	0.00	54.10	56.33	
780508	2	130.00	6.49	40.82	40.00	3.29	20.71	130.00	5.65	35.58	18.00	0.46	2.90	15.89	15.45	
780921	3	186.00	9.28	41.60	69.00	5.68	25.45	169.00	7.35	32.95	0.00	0.00	0.00	22.31	21.36	
790606	4	230.00	11.48	35.71	95.00	7.82	24.32	260.00	11.31	35.19	60.00	1.53	4.77	32.14	32.49	
790912	5	390.00	19.46	39.18	100.00	8.23	16.57	470.00	20.44	41.16	60.00	1.53	3.09	49.67	48.28	
791121	6	310.00	15.47	35.36	95.00	7.82	17.87	435.00	18.92	43.26	60.00	1.53	3.51	43.74	42.92	
800612	7	300.00	14.97	42.26	108.00	8.89	25.09	240.00	10.44	29.47	44.00	1.13	3.18	35.42	36.89	
810609	8	258.00	12.87	43.62	87.00	7.16	24.26	138.00	8.18	27.71	51.00	1.30	4.42	29.52	29.24	
811013	9	220.00	10.98	49.85	17.00	1.40	6.35	190.00	8.26	37.53	54.00	1.38	6.27	22.02	27.37	*
820614	10	370.00	18.46	51.02	114.00	9.38	25.92	160.00	6.96	19.23	54.00	1.38	3.82	36.18	32.89	
821116	11	25.00	1.25	76.71	2.70	0.22	13.66	3.20	0.14	8.56	0.68	0.02	1.07	1.63	1.54	
830613	12	27.00	1.35	79.83	2.40	0.20	11.70	2.90	0.13	7.47	0.66	0.02	1.00	1.69	1.73	
831116	13	24.00	1.20	72.38	2.60	0.21	12.93	3.00	0.13	7.89	4.40	0.11	6.80	1.65	1.75	
840613	14	35.00	1.75	73.80	1.86	0.15	6.47	9.77	0.42	17.96	1.64	0.04	1.77	2.37	2.10	
850915	15	28.30	1.41	58.90	4.96	0.41	17.02	6.80	0.30	12.34	11.00	0.28	11.74	2.40	2.37	
860729	16	31.00	1.55	63.83	4.90	0.40	16.64	5.00	0.22	8.97	10.00	0.26	10.55	2.42	2.33	

* Indicates that cations and anions do not lie within 10% of mean

Anions

Date	Number	Chloride			Sulphate			Bicarbonate as CaCO3			Carbonate as CaCO3			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Anion	Cation	
770610	1	1300.00	36.67	65.10	710.00	14.78	26.24	244.00	4.88	8.66	0.00	0.00	0.00	56.33	54.10	
780508	2	150.00	4.23	27.38	270.00	5.62	36.38	280.00	5.60	36.23	0.00	0.00	0.00	15.45	15.89	
780921	3	213.00	6.01	28.13	308.00	6.41	30.03	447.00	8.94	41.84	0.00	0.00	0.00	21.36	22.31	
790606	4	300.00	8.46	26.04	770.00	16.03	49.34	400.00	8.00	24.61	0.00	0.00	0.00	32.49	32.14	
790912	5	840.00	23.69	49.08	960.00	19.99	41.40	230.00	4.60	9.52	0.00	0.00	0.00	48.28	49.67	
791121	6	565.00	15.94	37.13	1060.00	22.07	51.42	246.00	4.92	11.46	0.00	0.00	0.00	42.92	43.74	
800612	7	310.00	8.74	23.70	1060.00	22.07	59.82	304.00	6.08	16.47	0.00	0.00	0.00	36.89	35.42	
810609	8	166.00	4.68	16.01	850.00	17.70	60.53	343.00	6.86	23.45	0.00	0.00	0.00	29.24	29.52	
811013	9	160.00	4.51	16.49	800.00	16.66	60.86	310.00	6.20	22.65	0.00	0.00	0.00	27.37	22.02	*
820614	10	160.00	4.51	13.72	970.00	20.20	61.41	375.00	7.50	22.80	34.00	0.68	2.07	32.89	36.18	
821116	11	4.80	0.14	8.79	30.00	0.62	40.57	39.00	0.78	50.64	<5.00	0.00	0.00	1.54	1.63	
830613	12	5.00	0.14	8.17	30.00	0.62	36.20	48.00	0.96	55.62	<5.00	0.00	0.00	1.73	1.69	
831116	13	5.90	0.17	9.53	24.00	0.50	28.62	54.00	1.08	61.84	<5.00	0.00	0.00	1.75	1.65	
840613	14	13.00	0.37	17.44	44.00	0.92	43.57	41.00	0.82	38.99	<5.00	0.00	0.00	2.10	2.37	
850915	15	8.47	0.24	10.08	57.20	1.19	50.26	47.00	0.94	39.66	<5.00	0.00	0.00	2.37	2.40	
860729	16	5.00	0.14	6.06	58.00	1.21	51.87	49.00	0.98	42.08	<5.00	0.00	0.00	2.33	2.42	

* Indicates that cations and anions do not lie within 10% of mean

Table III

Major Ion Chemistry
Booth Quarry Ground Water
Location OW-1-82

Cations

Date	Number	Calcium			Magnesium			Sodium			Potassium			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Cation	Anion	
770610	1	110.00	5.49	52.72	54.00	4.44	42.68	11.00	0.48	4.60	0.00	0.00	0.00	10.41	14.65	*
780508	2	120.00	5.99	47.54	45.00	3.70	29.40	65.00	2.83	22.45	3.00	0.08	0.61	12.60	24.74	*
780921	3	90.00	4.49	38.60	53.00	4.36	37.48	64.00	2.78	23.92	0.00	0.00	0.00	11.64	11.42	
790606	4	160.00	7.98	46.64	65.00	5.35	31.24	84.00	3.65	21.34	5.20	0.13	0.78	17.12	19.20	
820614	5	65.00	3.24	33.60	16.00	1.32	13.64	103.00	4.48	46.41	24.00	0.61	6.36	9.65	7.61	*
821116	6	53.00	2.64	25.20	17.00	1.40	13.33	136.00	5.92	56.36	21.00	0.54	5.12	10.50	11.27	
830613	7	57.00	2.84	23.88	18.00	1.48	12.43	165.00	7.18	60.25	16.00	0.41	3.44	11.91	12.27	
831116	8	74.00	3.69	28.76	21.00	1.73	13.46	160.00	6.96	54.20	18.00	0.46	3.59	12.84	12.02	
840613	9	59.50	2.97	25.19	18.00	1.48	12.57	160.00	6.96	59.05	14.70	0.38	3.19	11.79	12.19	
850915	10	59.50	2.97	27.40	19.60	1.61	14.89	134.00	5.83	53.79	16.60	0.42	3.92	10.84	11.24	
860729	11	63.00	3.14	26.57	21.00	1.73	14.61	150.00	6.52	55.15	17.00	0.43	3.68	11.83	12.49	

* Indicates that cations and anions do not lie within 10% of mean

Anions

Date	Number	Chloride			Sulphate			Bicarbonate as CaCO3			Carbonate as CaCO3			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Anion	Cation	
770610	1	100.00	2.82	19.26	206.00	4.29	29.28	377.00	7.54	51.46	0.00	0.00	0.00	14.65	10.41	*
780508	2	80.00	2.26	9.12	590.00	12.28	49.66	510.00	10.20	41.22	0.00	0.00	0.00	24.74	12.60	*
780921	3	66.00	1.86	16.30	0.00	0.00	0.00	478.00	9.56	83.70	0.00	0.00	0.00	11.42	11.64	
790606	4	110.00	3.10	16.16	370.00	7.70	40.12	420.00	8.40	43.73	0.00	0.00	0.00	19.20	17.12	
820614	5	42.00	1.18	15.57	102.00	2.12	27.92	191.00	3.82	50.20	24.00	0.48	6.31	7.61	9.65	*
821116	6	63.00	1.78	15.76	170.00	3.54	31.39	274.00	5.48	48.59	24.00	0.48	4.26	11.27	10.50	
830613	7	93.00	2.62	21.38	180.00	3.75	30.55	295.00	5.90	48.07	<5.00	0.00	0.00	12.27	11.91	
831116	8	95.00	2.68	22.29	150.00	3.12	25.98	285.00	5.70	47.40	26.00	0.52	4.32	12.02	12.84	
840613	9	92.00	2.59	21.29	163.00	3.39	27.85	310.00	6.20	50.86	<5.00	0.00	0.00	12.19	11.79	
850915	10	98.80	2.79	24.80	115.00	2.39	21.30	303.00	6.06	53.90	<5.00	0.00	0.00	11.24	10.84	
860729	11	125.00	3.53	28.24	126.00	2.62	21.01	317.00	6.34	50.75	<5.00	0.00	0.00	12.49	11.83	

* Indicates that cations and anions do not lie within 10% of mean

Table IV

Major Ion Chemistry
Booth Quarry Ground Water
Location OW-2-77

Cations

Date	Number	Calcium			Magnesium			Sodium			Potassium			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Cation	Anion	
770822	1	125.00	6.24	56.38	27.00	2.22	20.08	54.00	2.35	21.23	10.00	0.26	2.31	11.06	12.28	
780508	2	85.00	4.24	47.31	40.00	3.29	36.71	30.00	1.30	14.55	5.00	0.13	1.43	8.97	12.87	*
780921	3	96.00	4.79	47.83	45.00	3.70	36.97	35.00	1.52	15.20	0.00	0.00	0.00	10.02	11.61	
790606	4	100.00	4.99	44.65	55.00	4.53	40.49	34.00	1.48	13.23	7.10	0.18	1.62	11.18	12.29	
790912	5	130.00	6.49	53.05	49.00	4.03	32.97	34.00	1.48	12.09	9.00	0.23	1.88	12.23	11.08	
791121	6	98.00	4.89	45.55	49.00	4.03	37.56	37.00	1.61	14.99	8.00	0.20	1.91	10.74	10.81	
800612	7	92.00	4.59	45.43	44.00	3.62	35.83	40.00	1.74	17.22	6.00	0.15	1.52	10.10	10.98	
810609	8	100.00	4.99	47.94	47.00	3.87	37.16	32.00	1.39	13.37	6.20	0.16	1.52	10.41	11.12	
811013	9	97.00	4.84	47.11	43.00	3.54	34.44	39.00	1.70	16.51	7.80	0.20	1.94	10.27	11.34	
820614	10	115.00	5.74	51.40	46.00	3.79	33.91	34.00	1.48	13.25	6.30	0.16	1.44	11.16	8.05	*
821116	11	129.00	6.44	62.85	30.00	2.47	24.10	28.00	1.22	11.89	4.60	0.12	1.15	10.24	10.17	
830613	12	107.00	5.34	52.26	40.00	3.29	32.22	33.00	1.44	14.05	5.90	0.15	1.48	10.22	11.07	
831116	13	136.00	6.79	55.61	45.00	3.70	30.34	35.00	1.52	12.48	7.50	0.19	1.57	12.20	10.16	
840613	14	100.00	4.99	49.94	42.00	3.46	34.59	32.00	1.39	13.93	6.03	0.15	1.54	9.99	9.69	
860729	15	100.00	4.99	49.40	39.00	3.21	31.77	39.00	1.70	16.80	8.00	0.20	2.03	10.10	9.91	

* Indicates that cations and anions do not lie within 10% of mean

Anions

Date	Number	Chloride			Sulphate			Bicarbonate as CaCO3			Carbonate as CaCO3			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Anion	Cation	
770822	1	40.00	1.13	9.19	217.00	4.52	36.78	332.00	6.64	54.03	0.00	0.00	0.00	12.28	11.06	
780508	2	25.00	0.71	5.48	210.00	4.37	33.96	390.00	7.80	60.56	0.00	0.00	0.00	12.87	8.97	*
780921	3	26.00	0.73	6.32	145.00	3.02	26.00	393.00	7.86	67.68	0.00	0.00	0.00	11.61	10.02	
790606	4	26.00	0.73	5.97	190.00	3.96	32.20	380.00	7.60	61.83	0.00	0.00	0.00	12.29	11.18	
790912	5	26.00	0.73	6.62	180.00	3.75	33.83	330.00	6.60	59.55	0.00	0.00	0.00	11.08	12.23	
791121	6	28.00	0.79	7.30	180.00	3.75	34.65	314.00	6.28	58.04	0.00	0.00	0.00	10.81	10.74	
800612	7	27.00	0.76	6.94	192.00	4.00	36.42	311.00	6.22	56.64	0.00	0.00	0.00	10.98	10.10	
810609	8	28.00	0.79	7.10	192.00	4.00	35.93	317.00	6.34	56.97	0.00	0.00	0.00	11.12	10.41	
811013	9	28.00	0.79	6.96	190.00	3.96	34.87	330.00	6.60	58.16	0.00	0.00	0.00	11.34	10.27	
820614	10	23.00	0.65	8.06	104.00	2.17	26.89	247.00	4.94	61.33	15.00	0.30	3.72	8.05	11.16	*
821116	11	24.00	0.68	6.66	113.00	2.35	23.14	357.00	7.14	70.20	<5.00	0.00	0.00	10.17	10.24	
830613	12	31.00	0.87	7.90	190.00	3.96	35.74	312.00	6.24	56.36	<5.00	0.00	0.00	11.07	10.22	
831116	13	20.00	0.56	5.55	150.00	3.12	30.72	299.00	5.98	58.81	25.00	0.50	4.92	10.16	12.20	
840613	14	18.00	0.51	5.24	150.00	3.12	32.24	303.00	6.06	62.52	<5.00	0.00	0.00	9.69	9.99	
860729	15	31.50	0.89	8.97	148.00	3.08	31.10	297.00	5.94	59.93	<5.00	0.00	0.00	9.91	10.10	

* Indicates that cations and anions do not lie within 10% of mean

Table V

Major Ion Chemistry
Booth Quarry Ground Water
Location OW-6-82

Cations

Date	Number	Calcium			Magnesium			Sodium			Potassium			Total Ions (EPM)	
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Cation	Anion
820614	1	127.00	6.34	38.66	45.00	3.70	22.59	119.00	5.18	31.58	46.00	1.18	7.18	16.39	14.45
821116	2	120.00	5.99	37.57	45.00	3.70	23.24	123.00	5.35	33.57	35.00	0.90	5.62	15.94	16.04
830309	3	134.00	6.69	42.14	50.00	4.11	25.93	100.00	4.35	27.41	28.00	0.72	4.51	15.87	17.28
830613	4	124.00	6.19	39.36	45.00	3.70	23.55	117.00	5.09	32.37	29.00	0.74	4.72	15.72	16.74
831116	5	155.00	7.73	45.40	48.00	3.95	23.18	106.00	4.61	27.06	29.00	0.74	4.35	17.04	16.02
840613	6	128.00	6.39	42.44	44.40	3.65	24.28	101.00	4.39	29.19	24.10	0.62	4.10	15.05	15.25
850915	7	108.00	5.39	38.99	38.50	3.17	22.92	106.00	4.61	33.36	25.60	0.65	4.74	13.82	14.92
860729	8	134.00	6.69	44.15	34.00	2.80	18.47	116.00	5.05	33.32	24.00	0.61	4.05	15.14	14.22

* Indicates that cations and anions do not lie within 10% of mean

Anions

Date	Number	Chloride			Sulphate			Bicarbonate as CaCO3			Carbonate as CaCO3			Total Ions (EPM)	
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Anion	Cation
820614	1	67.00	1.89	13.07	350.00	7.29	50.41	240.00	4.80	33.19	24.00	0.48	3.32	14.45	16.39
821116	2	65.50	1.85	11.52	333.00	6.93	43.23	333.00	6.66	41.51	30.00	0.60	3.74	16.04	15.94
830309	3	94.00	2.65	15.34	355.00	7.39	42.77	321.00	6.42	37.14	41.00	0.82	4.74	17.28	15.87
830613	4	66.00	1.86	11.12	370.00	7.70	46.01	359.00	7.18	42.87	<5.00	0.00	0.00	16.74	15.72
831116	5	60.00	1.69	10.56	330.00	6.87	42.89	348.00	6.96	43.43	25.00	0.50	3.12	16.02	17.04
840613	6	58.00	1.64	10.73	316.00	6.58	43.14	352.00	7.04	46.14	<5.00	0.00	0.00	15.25	15.05
850915	7	63.10	1.78	11.93	292.00	6.08	40.76	353.00	7.06	47.31	<5.00	0.00	0.00	14.92	13.82
860729	8	63.00	1.78	12.50	277.00	5.77	40.55	334.00	6.68	46.95	<5.00	0.00	0.00	14.22	15.14

* Indicates that cations and anions do not lie within 10% of mean

Table VI

Major Ion Chemistry
Booth Quarry Ground Water
Location OW-8-77

Cations

Date	Number	Calcium			Magnesium			Sodium			Potassium			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Cation	Anion	
770822	1	180.00	8.98	55.55	53.00	4.36	26.97	62.00	2.70	16.68	5.00	0.13	0.79	16.17	13.46	
780508	2	280.00	13.97	64.87	15.00	1.23	5.73	145.00	6.31	29.28	1.00	0.03	0.12	21.54	14.16	*
780921	3	118.00	5.89	67.77	15.00	1.23	14.21	36.00	1.57	18.02	0.00	0.00	0.00	8.69	20.06	*
790606	4	140.00	6.99	67.25	18.00	1.48	14.26	43.00	1.87	18.00	2.00	0.05	0.49	10.39	10.80	
790912	5	150.00	7.49	70.04	15.00	1.23	11.55	43.00	1.87	17.50	3.80	0.10	0.91	10.69	9.30	
791121	6	128.00	6.39	66.91	16.00	1.32	13.79	41.00	1.78	18.68	2.30	0.06	0.62	9.55	9.72	
800612	7	112.00	5.59	64.51	15.60	1.28	14.82	40.00	1.74	20.08	2.00	0.05	0.59	8.66	9.45	
810609	8	124.00	6.19	69.20	15.00	1.23	13.80	34.00	1.48	16.54	1.60	0.04	0.46	8.94	9.10	
811013	9	127.00	6.34	44.60	77.00	6.34	44.59	34.00	1.48	10.41	2.25	0.06	0.40	14.21	10.29	*
820614	10	133.00	6.64	71.00	14.00	1.15	12.33	35.00	1.52	16.29	1.40	0.04	0.38	9.35	7.51	*
821116	11	122.00	6.09	69.55	16.00	1.32	15.04	30.00	1.30	14.91	1.70	0.04	0.50	8.75	8.65	
830613	12	108.00	5.39	69.47	13.00	1.07	13.79	29.00	1.26	16.26	1.46	0.04	0.48	7.76	7.90	
831116	13	138.00	6.89	72.43	15.00	1.23	12.98	31.00	1.35	14.18	1.50	0.04	0.40	9.51	7.95	
840613	14	117.00	5.84	74.02	15.00	1.23	15.65	16.20	0.70	8.93	4.31	0.11	1.40	7.89	7.94	
860729	15	114.00	5.69	68.77	14.00	1.15	13.93	32.00	1.39	16.83	1.54	0.04	0.48	8.27	8.17	

* Indicates that cations and anions do not lie within 10% of mean

Anions

Date	Number	Chloride			Sulphate			Bicarbonate as CaCO3			Carbonate as CaCO3			Total Ions (EPM)		
		mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	mg/L	EPM	%EPM	Anion	Cation	
770822	1	105.00	2.96	22.00	197.00	4.10	30.47	320.00	6.40	47.53	0.00	0.00	0.00	13.46	16.17	
780508	2	85.00	2.40	16.93	200.00	4.16	29.41	380.00	7.60	53.66	0.00	0.00	0.00	14.16	21.54	*
780921	3	51.00	1.44	7.17	538.00	11.20	55.85	371.00	7.42	36.98	0.00	0.00	0.00	20.06	8.69	*
790606	4	46.00	1.30	12.01	130.00	2.71	25.06	340.00	6.80	62.93	0.00	0.00	0.00	10.80	10.39	
790912	5	35.00	0.99	10.62	140.00	2.91	31.34	270.00	5.40	58.04	0.00	0.00	0.00	9.30	10.69	
791121	6	35.00	0.99	10.16	136.00	2.83	29.14	295.00	5.90	60.70	0.00	0.00	0.00	9.72	9.55	
800612	7	34.00	0.96	10.15	140.00	2.91	30.84	279.00	5.58	59.01	0.00	0.00	0.00	9.45	8.66	
810609	8	37.00	1.04	11.47	120.00	2.50	27.46	278.00	5.56	61.08	0.00	0.00	0.00	9.10	8.94	
811013	9	28.00	0.79	7.68	120.00	2.50	24.29	350.00	7.00	68.03	0.00	0.00	0.00	10.29	14.21	*
820614	10	32.00	0.90	12.02	80.00	1.67	22.19	230.00	4.60	61.26	17.00	0.34	4.53	7.51	9.35	*
821116	11	24.00	0.68	7.82	94.00	1.96	22.62	301.00	6.02	69.55	<5.00	0.00	0.00	8.65	8.75	
830613	12	29.00	0.82	10.35	105.00	2.19	27.67	245.00	4.90	61.98	<5.00	0.00	0.00	7.90	7.76	
831116	13	23.00	0.65	8.16	100.00	2.08	26.19	239.00	4.78	60.11	22.00	0.44	5.53	7.95	9.51	
840613	14	47.00	1.33	16.70	90.00	1.87	23.61	237.00	4.74	59.69	<5.00	0.00	0.00	7.94	7.89	
860729	15	33.00	0.93	11.39	101.00	2.10	25.73	257.00	5.14	62.88	<5.00	0.00	0.00	8.17	8.27	

* Indicates that cations and anions do not lie within 10% of mean

TABLE VII

SURVEY OF WATER TABLE AT BOOTH QUARRY ASH DISPOSAL SITE
JUNE, 1982 to JULY 1986

Observation Well Location	Elevation* of Ground Level (m)	Elevation* of Water Table (m)						
		82 06 21	82 11 05	83 06 08	83 11 09	84 06 08	85 08 29	86 07 29
OW-1-82	103.44	100.81	101.05	101.19	100.91	101.15	101.11	101.21
OW-2-77	102.07	101.36	101.58	101.32	100.85	101.14	NA	101.09
OW-6-82	101.51	99.08	99.15	99.43	99.31	99.51	99.60	99.86
OW-7-82	101.41	97.00	97.03	97.36	N.D.**	N.D.**	98.72	99.40
OW-8-77	102.25	100.46	100.55	100.40	100.14	100.27	NA+	100.30
Central Sump	101.46	96.47	96.87	97.56	97.79	98.71	99.18	99.61

* All elevations refer to geodetic datum.

** N.D. denotes not determined - observation well practically dry.

\+ NA denotes not accessible due to local construction.

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